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13. ABSTRACT (Maximum 200 words)

Surfactant vesicles are small, spherical shell-like structures composed of bilayers of surfactant molecules which can be used to contain an aqueous solution. Since a variety of materials can be encapsulated in such vesicles, they are ideal vehicles for many different applications. The advantages of vesicle formulations involve protection from the environment, sustained release, and targeted delivery of vesicle contents. Such potential for phospholipid vesicles as chemical delivery systems, and possibly many other roles has motivated a significant effort towards

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DEVELOPMENT OF MICROENCAPSULATION TECHNIQUES

FINAL TECHNICAL REPORT

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Professor of Chemistry

14 May 1990

U. S. ARMY RESEARCH OFFICE

For

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Final Report May 3, 1990

DEVELOPMENT OF MICROENCAPSULATION TECHNIQUES

Surfactant vesicles are small, spherical shell-like structures composed of bilayers of surfactant molecules which can be used to contain an aqueous solution. Since a variety of materials can be encapsulated in such vesicles, they are ideal vehicles for many different applications. The advantages of vesicle formulations involve protection from the environment, sustained release, and targeted delivery of vesicle contents. Such potential for phospholipid vesicles as chemical delivery systems, and possibly many other roles has motivated a significant effort towards improving their properties. The primary objectives for much of the current research in this area have therefore been to obtain enhanced membrane stability (mechanical and chemical) and decreased or controlled vesicle fusion and permeability. Major progress toward these ends has been made by the introduction of polymerizeable lipid analogues(1) and to a lesser extent with the formation of polymer coated vesicles(2).

With support of the Army Research Office (Grant No. DAAL03-87-K-0044) we have explored the effects of disulfide polymerization and incorporation of cholesterol derivatives on the structure and properties (permeability, stability, and size) of phospholipid vesicles. We have also initiated studies of the interaction of polymers with liposomes.

The detailed results of these studies have been published or submitted for publication as follows:

1. Handel, Tracy M., "Disulfide Polymerizeable Phosphatidylcholines: Characterization of Membrane Physical Properties and Investigations of *in vivo* Behavior". Ph.D. diss., California Institute of Technology, Pasadena, CA, 1989.
2. Goodrich, Raymond P., "Membrane Bound Carbohydrates: An Approach for Stabilization During Freezing and Drying". Ph.D. Diss., California Institute of Technology, Pasadena, CA. 1990.
3. Goodrich, Raymond P., Handel, Tracy M. BBA 938, 143-154, 1988.
4. Goodrich, Raymond P., Crowe, John H., Crowe, Lois M., Baldeschwieler, John D. Biochem. 1990, submitted. "Alterations in Membrane Surfaces Induced by Attachment of Carbohydrates".

5. Goodrich, Raymond P., John D. Baldeschwieler, BBA 1990, submitted. "Protection of Vesicles Against Damage During Freeze Drying by Addition of Membrane Associated Carbohydrate Derivatives".
6. Goodrich, Raymond P., Baldeschwieler, John D., Cryobiology 1990, submitted. "The Cryoprotective Action of Synthetic Glycolipids".

I have attached copies of the abstracts of the two theses (nos. 1. and 2.) as well as preprints of the three manuscripts which have recently been submitted for publication.

List of scientific personnel:

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Mitsuko Fujiwara
Raymond P. Goodrich, Ph.D., 1990
Tracy M. Handel, Ph.D., 1989
Wilton Vannier, M.D., Ph.D.